REMARKS

Applicants' attorney wishes to first thank Examiner Edgar for indicating the allowability of claims 4, 5, 7, 14, 15 and 17.

Reconsideration and allowance of the remaining claims is respectfully requested in view of the above amendments and following remarks. Support for these amendments can be found in the original specification and claims. No new matter has been introduced by these amendments.

Claims 1-24 are pending in the present application. Claims 4, 5, 7, 14, 15 and 17, 10 are objected to. Claims 1-3, 6, 8-13, 16 and 18-24 presently stand rejected. Claims 1, 10 and 20 have been amended to more clearly define the invention.

Support for the amendments is found in the Applicants' specification paragraphs [032-034] and Figure 5, specifically first wall portion (inner surface) 65 and second wall portion (exterior surface) 67 of either sidewalls 28, 30.

A. Claim Rejections – 35 USC 103

a) The Examiner has rejected Claims 1-3, 6, 8-11, 13, 16, 18-21, 23 and 24 under 35 USC 103(a) as being unpatentable over Moore (US patent number 3,801,218) in view of Kvasnak et al. (US patent application no. 2002/0021966).

Moore teaches an airfoil with longitudinally extending cooling air passages 21 in the interior of the blade. Communicating with each of the passages 21 is a plurality of discrete chord-wise holes 22 [Figure 2] that extend from one side only of the passages 21 to connect the passages to one of the working surfaces of the blade [Col. 1, lines 65-67].

Moore teaches that the holes 22 should be as long as possible to maximize heat transfer and the holes 22 should cover the greatest external surface area of the blade so as to avoid large external surface areas with no holes. [Col. 2, lines 3-13] These discrete holes are produced by laser drill etc. [Col. 2 lines 57-62]. In order to accomplish this, the passages 21 are centered around the camber line 20 as shown in Figure 2.

Kvasnak et al. teaches a plurality of microcircuits [Figure 5] disposed in the wall of the airfoil. Kvasnak et al. also teaches that the cooling circuits 22 located on both the pressure and suction sides are fed from the *same* cavity 42. The cooling circuits 22 are

distinguished over the prior art conventional airfoil design where the apertures are drilled holes that extend from a cavity to an exterior surface. [Figure 6, page 1, paragraph 0009]. The cooling circuits 22 of Kvasnak et al. are not simple holes as clearly shown in Figure 5. Kvasnak et al. teaches an advantage of microcircuits over conventional cooling apertures such as the discrete holes 22 shown in Moore. The problem identified in Kvasnak et al. is how to use less cooling air and provide greater cooling effectiveness. This is achieved by the microcircuits as shown in Figure 3 of Kvasnak et al. [para 0011].

Also, the Examiner has pointed out, that Kvasnak et al. shows cooling passages 42 that are the cross sectional shape of the longitudinally extending passages which were maximized by providing a partition between the airfoil sidewalls for the for the purpose of increasing the cross sectional area of the passages while supporting the airfoil shape.

As previously noted, the Examiner points out that it would have been obvious to one skilled in the art to modify the cooling configuration so that the cross sectional shape of the longitudinally extending passages were maximized by providing a partition between the airfoil sidewalls, as taught by Kvasnak et al., for the for the purpose of increasing the cross- sectional area of the passages while supporting the airfoil shape.

Applicants first wish to point out that there is no motivation in Moore to configure the passages as taught by Kvasnak et al. In fact, Moore teaches away from such a modification. Moore teaches that the lengths of the holes 22 must be maximized as shown in Figure 2 [Col. 2, lines 3-13]. In order to achieve this, the passages cannot be maximized as shown in Kvasnak et al. as this would be counterproductive to obtain the necessary heat transfer in the holes 22 of Moore. This is why in Moore the airfoil configuration cannot be a thin wall airfoil as shown in Kvasnak et al. If the modification, as suggested by the Examiner, were done, it would destroy the purpose and result of the Moore invention. Thus, one skilled in the art would not find any reason to make the modification or combine Moore and Kvasnak et al to arrive at Applicant's invention. Applicants respectfully state that without the benefits of Applicant's invention, one skilled in the art would find no teaching, motivation or suggestion to combine the references as suggested by the Examiner.

The present invention identifies a problem with benefits achieved as provided for in amended claim 1, which recites in part,

a plurality of cooling circuits disposed between said first wall portion and said second wall portion of ~~embedded within~~ said pressure sidewall, wherein each of said cooling circuits includes:

an inlet, said inlet provides a cooling flow path from said first flow passage into each of said cooling circuits, ~~and~~

at least one pedestal extending between said first wall portion and said second wall portion of said pressure sidewall, and

an exit aperture, said exit aperture provides a cooling flow path out of each of said cooling circuits to a region outside of the airfoil; and

a plurality of cooling circuits disposed between said first wall portion and said second wall portion of ~~embedded within~~ said suction sidewall, wherein each of said cooling circuits embedded within said suction sidewall includes:

an inlet, said inlet provides a cooling flow path from said second flow passage into each of said cooling circuits embedded within said suction sidewall, ~~and~~

at least one pedestal extending between said first wall portion and said second wall portion of said suction sidewall, and

an exit aperture, said exit aperture provides a cooling flow path out of each of said cooling circuits embedded within said suction sidewall to said region outside the airfoil.

Applicants' invention claims a microcircuit that is not a drilled hole but rather a microcircuit with at least one pedestal. Applicants' invention further claims that the microcircuits located on the suction side and the pressure side cannot be fed from the same cavity. This combination claimed by Applicant is not obvious from the cited prior art without the benefit of Applicants' invention. This is evidenced by the fact that Kvasnak et al. shows cooling circuits with pedestals and teaches that the microcircuits located on the pressure and suction sidewalls are fed from the *same* cavity or passage. Thus, Kvasnak et al. teaches away from the present invention of supplying the suction

side cooling circuits [e.g. microcircuits] only from a passage that does not supply the pressure side microcircuits and visa versa.

Thus, Applicants' invention of an airfoil having microcircuits on both the suction and pressure sidewalls where the microcircuits on the pressure sidewall cannot be fed from the same passage as the microcircuits on the suction sidewall is not suggested or taught be any of the prior art nor is there any suggestion to combine Moore and Kvasnak et al.

Further, Kvasnak et al. does not teach or suggest the interplay and impact of small Mach numbers, high rotational speed, large rotational numbers, Coriolis forces and buoyancy effects and their impact on the microcircuits and in particular the larger pressure drop that occurs across the microcircuits 22. Thus, Kvasnak et al. does not identify or hint at the problem that is solved by the present invention nor provide any solution. Since Moore teaches stem drilled holes 22, the pressure drop and heat transfer characteristics, as pointed out by Kvasnak et al., are very different from the microcircuits that are described in Kvasnak et al. Thus, Moore also cannot identify the problem solved by Applicant's invention and nor provide any possible solution. Thus, there is would be no motivation to combine the elements of these two references that could result in Applicant's invention since the cooling designs shown in Moore and Kvasnak et al. are addressing very different heat transfer problems.

Applicants respectfully submit that there are no teachings or suggestion in either Moore or Kvansk et al. as to how to replace or modify any of the elements of Moore with the elements of Kvasnak et al. such as to recite Applicants claimed invention as recited in amended claim 1. Thus, without the benefits of Applicants' invention, there can be no teaching or motivation in the art to combine the cited references to produce this result as claimed in the present application.

However, even if Moore and Kvasnak et al. are combined, the newly claimed invention could not result since the claimed invention provides benefits that are not provided or suggested by the cited prior art. Namely, a pressure side microcircuit having at least one pedestal and a suction side microcircuit having at least one pedestal and, as recited in amended claim 1,

wherein said first flow passage is not in flow communication with said cooling circuits embedded within said suction sidewall and said second flow passage is not in flow communication with said cooling circuits embedded within said pressure sidewall

such that said first flow passage feeds the coolant fluid to said cooling circuits that are embedded only within said pressure sidewall and said second flow passage feeds the coolant fluid to said cooling circuits that are embedded only within said suction sidewall.

Applicant submits that Moore lacks the recited features of the present invention and which would not have been obvious to encompass within Moore from Kvasnak et al. without the teachings of the present invention, and which are further also not taught by Kvasnak et al.

Applicants respectfully submit that amended claims 1, 10 and 20, and dependent claims 2-9, 11-19, and 21-24, which depends from amended claims 1, 10 and 20, respectively, are allowable over the prior art of record for at least the reason cited above with respect to amended claims 1, 10 and 20.

In view of Applicants' amendments and accompanying remarks, reconsideration of this rejection is respectfully requested of the Examiner.

b) The Examiner has rejected Claims 12 and 22 under 35 USC 103(a) as being unpatentable over Moore (US patent number 3,801,218) in view of Kvasnak et al. (US patent application no. 2002/0021966) and further in view of Burke et al. (US patent number 6,331,217.

Claims 12 depends from claim 10 and claim 22 depends from claim 20. As recited hereinabove, it is respectfully submitted that amended claims 10 and 20 are allowable over the recited art. The Burke et al. reference does not make up for the deficiency in the Moore and Kvasnak et al. reference.

Thus it is respectfully submitted that claims 12 and 22 are patentable over the cited references for at least the reasons discussed above with reference to claims 10 and 20.

In view of Applicant's amendments and accompanying remarks, reconsideration of this rejection is respectfully requested of the Examiner.

With the above remarks in mind, Applicants respectfully request that the Examiner please reconsider the rejection of claims 1-3, 6, 8-13, 16 and 18-24 .

Summary

After careful consideration of the Examiner's Office Action and in light of Applicants' amendments and accompanying remarks, it is respectfully submitted that all of the pending claims 1-24 are allowable over the applied references as well as the prior art made of record. Allowance of claims 1-24 is respectfully requested.

Applicants respectfully submit that this amendment introduces no new issues which have not been previously been considered and is appropriate for entry. Accordingly, Applicants respectfully request reconsideration of the reference application and entry of this amendment.

The Examiner is cordially invited to contact the undersigned by telephone to expedite any further issues or concerns.

Please charge any additional charges, fees, deficiency or credit any overpayment with respect to this Amendment or otherwise, to Deposit Account No. 21-0279, Docket Number EH-11037A.

Respectfully submitted,
Cunha et al.

By: Linda A P Cunha
Linda A. P. Cunha
Registration No. 45,767

Pratt & Whitney
Patent Department
Mail Stop 132-13
400 Main Street
East Hartford, CT 06108
Phone: 860-557-3163